

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Education
Advanced Subsidiary/Advanced



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Addysg Gyffredinol
Uwch Gyfrannol/Uwch

331/01

CHEMISTRY CH1

A.M. THURSDAY, 11 January 2007

(1 hour 30 minutes)

FOR EXAMINER'S USE ONLY		
Section	Question	Mark
A	1-9	
B	10	
	11	
	12	
	13	
TOTAL MARK		

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a:

- calculator;
- copy of the **Periodic Table** supplied by WJEC. Refer to it for any **relative atomic masses** you require.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Section A Answer **all** questions in the spaces provided.

Section B Answer **all** questions in the spaces provided.

Candidates are advised to allocate their time appropriately between **Section A (10 marks)** and **Section B (56 marks)**.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The maximum mark for this paper is 66.

Your answers must be relevant and must make full use of the information given to be awarded full marks for a question.

You are reminded that marking will take into account the Quality of Written Communication used in all written answers.

Page 14 may be used for rough work.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

SECTION A

Answer **all** the questions in the spaces provided.

1. A solid melts at a temperature of just below 100°C. It does not conduct electricity, even when molten.

State which **one** of the following statements about its bonding and/or structure is **correct**.

- A** It is giant molecular.
B It is ionic.
C It is metallic.
D It is simple molecular.

..... [1]

2. State the Cl- \hat{C} -Cl bond angle in tetrachloromethane, CCl₄.

..... [1]

3. The ions Ca²⁺, Cl⁻ and K⁺ have the same number of electrons.

Place the ions in order of increasing radii.

[1]

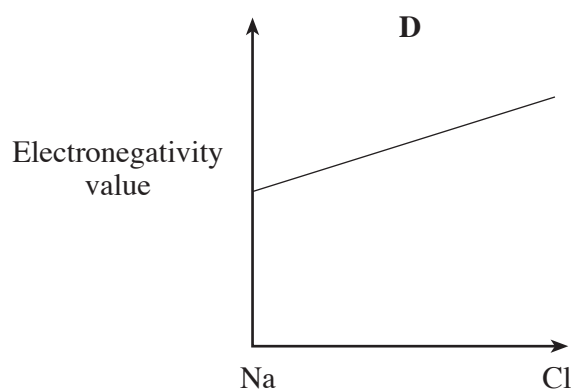
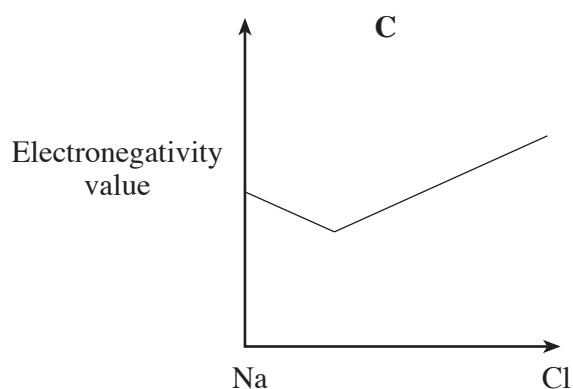
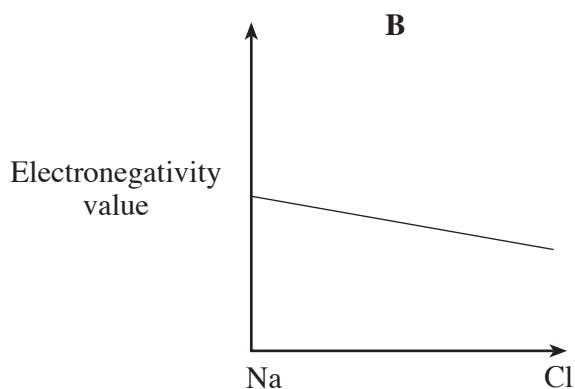
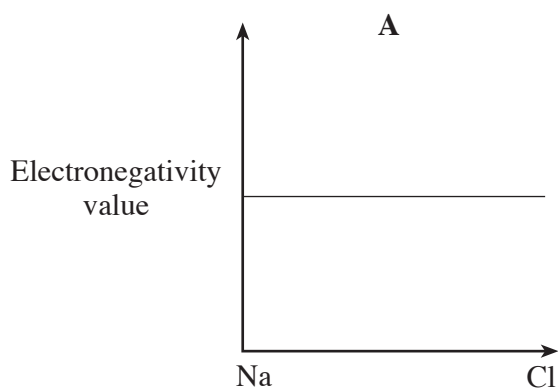
.....
 smallest largest

4. State the species which undergoes reduction in the following reaction.



..... [1]

5. State which **one** of the following graphs best shows how electronegativity changes across period 3 in the Periodic Table.



..... [1]

6. Complete the table to show the **type** or **types** of bonding present in the following solids.

<i>Solid</i>	<i>Type or types of bonding</i>
Sodium chloride	
Graphite	

[1]

7. State which **one** of the following particles, on **losing** an electron, would have a full set of 2p orbitals.

- A** F^-
B Ne
C Na
D Na^+

..... [1]

8. The mass spectrometer can be used to determine the relative atomic mass of an element.

(i) State how a mass spectrometer causes particles to be deflected. [1]

.....

(ii) State why a vacuum is needed inside the apparatus. [1]

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.....

9. Red lead oxide, Pb_3O_4 , has been used for making anti-corrosion paints. It is formed by oxidising lead(II) oxide with oxygen.

Balance the following equation for the reaction. [1]



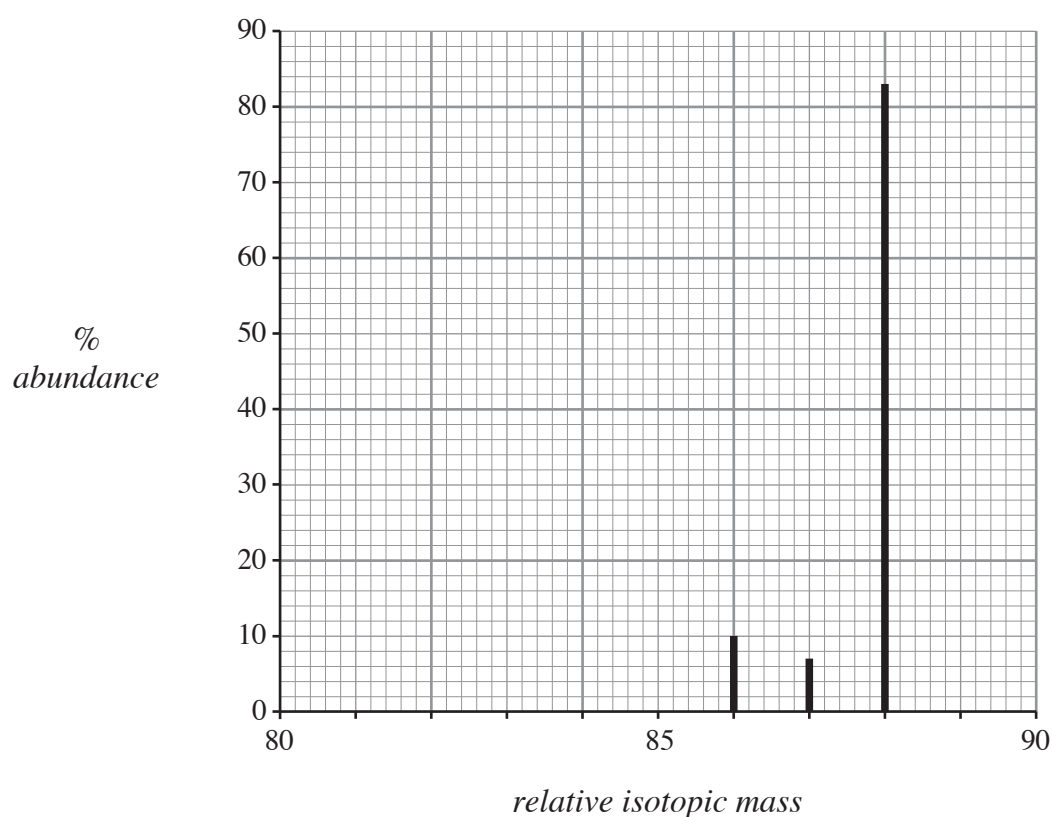
Section A Total [10]

SECTION B

Answer **all** the questions in the spaces provided.

10. (a) Strontium is the only element that takes its name from a British place-name. It was first isolated as an element in 1808 by the British chemist Sir Humphrey Davy and was named after the Scottish town Strontian, where ores containing strontium were discovered in the 1790's.

The mass spectrum of a naturally occurring sample of strontium is shown below.



- (i) Use this mass spectrum to complete the table below to show the percentage abundance and atomic structure for each strontium isotope in the sample. [2]

<i>isotope</i>	<i>% abundance</i>	<i>Protons</i>	<i>Neutrons</i>	<i>Electrons</i>
^{86}Sr				
^{87}Sr	7	38	49	38
^{88}Sr				

- (ii) Calculate the relative atomic mass of the strontium sample, showing your working. [2]

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- (b) The first three ionisation energies of strontium are shown in the table below.

<i>Ionisation</i>	<i>1st</i>	<i>2nd</i>	<i>3rd</i>
<i>Energy/kJ mol⁻¹</i>	548	1060	4120

Explain, in terms of the electronic structure of strontium, why there is a large difference between the second and third ionisation energy values. [3]

.....

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(c) Strontium-90 is a radioactive isotope of strontium that decays by β -emission and has a half-life of 27 years.

(i) Give the mass number and symbol of the element formed as a product of the radioactive decay of strontium-90. [1]

.....

(ii) Calculate the mass of strontium-90 remaining after 81 years if 1.6 g are originally present. [1]

.....

.....

(d) (i) Give the formula for strontium chloride. [1]

.....

(ii) Describe one test, giving practical details, which would distinguish between strontium chloride and barium chloride. [3]

Description of test

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Observations

.....

(e) State, with a reason, whether you would expect strontium sulphate to be soluble in water. [1]

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.....

Total [14]

11. (a) Describe briefly the essential features of a covalent bond. Explain why covalent compounds generally have low melting temperatures, despite covalent bonds being strong. [4]

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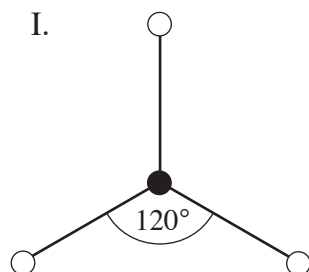
- (b) State how a coordinate bond differs from an ordinary covalent bond and give the **formula** of **one** species containing a coordinate bond. [2]

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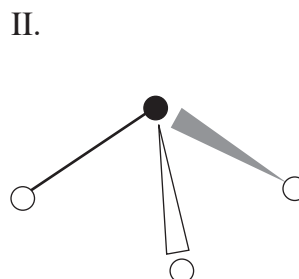
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- (c) Covalent molecules have definite shapes.

- (i) The diagram below shows two molecular shapes. Under each shape, write the **formula** of a molecule which corresponds to that shape. [2]



.....



.....

- (ii) Draw or name the shapes of the following molecules.

I. water, H₂O

II. sulphur hexafluoride, SF₆

[2]

.....

.....

(d) Ionic bonds often have some covalent character. This is influenced by the sizes and charges of the ions involved. State how these two factors must change, for positive ions and then for negative ions, to increase the covalent character in an ionic bond.

(i) *Positive ions:* [1]

.....
.....

(ii) *Negative ions:* [1]

.....
.....

(e) Draw a dot and cross diagram to show how the ionic compound barium chloride is formed from barium and chlorine atoms. Show the charges on the ions formed.

Only **outer** electrons should be shown. [2]

Total [14]

12. (a) Minerals containing zinc are important to the human body, since the Zn^{2+} ion is important in many enzymes. Zinc sulphate can be used as a dietary supplement in cases of zinc deficiency. The compound crystallises as a hydrated salt, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, and is soluble in water.

The recommended daily allowance (RDA) of zinc is 15.2 mg (0.0152 g).

- (i) Calculate the relative molecular mass of hydrated zinc sulphate crystals, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$. [1]

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- (ii) Calculate the mass of hydrated zinc sulphate crystals which would need to be taken to obtain the RDA for zinc.
(Assume that 1 mole of hydrated zinc sulphate contains 1 mole of zinc.) [2]

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- (iii) Normally this mass is taken via a 5 cm^3 dose of an aqueous solution of hydrated zinc sulphate, $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$. Calculate the concentration of this solution in g dm^{-3} . [1]

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- (b) Describe how you would obtain dry crystals of hydrated zinc sulphate from its aqueous solution. [2]

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- (c) Minerals containing iron are also important to the human body.

Write the electronic configuration of an iron atom in terms of s, p and d electrons.

[1]

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(d) 4.07 g of a chloride of iron was formed by reacting 1.40 g of iron with an excess of chlorine.

(i) Determine the empirical formula of the chloride. [2]

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.....

(ii) Describe a test, by stating reagent(s) and observation(s), to show that an aqueous solution of the chloride of iron contains Cl^- ions. [2]

Reagent(s)

Observation(s)

.....

(e) Hydrochloric acid also contains chloride ions. Manganese(IV) oxide, MnO_2 , when heated with hydrochloric acid, reacts according to the following equation.



Explain why this can be classified as a redox reaction. [2]

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(f) State and briefly explain how the reactivity of the elements in Group VII varies on descent of the group. [3]

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Total [16]

13. (a) Although diamond is a non-metal, it can show similar physical properties to metals.

Describe the structure and bonding in diamond and in metals.

State **one** physical property which is common to both diamond and metals and **one** which is not. Relate **both** properties to the structures and bonding you have described.

Diagrams may be used in support of your answer.

[7]

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- (b) Sodium chloride, NaCl, and aluminium chloride, Al₂Cl₆, are both metal chlorides, yet their behaviour with water is different. Describe what happens when each is added separately to water and give a reason for the difference. [2]

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- (c) Briefly explain why the hydrocarbon ethane, C₂H₆, is insoluble in water yet ethanol, C₂H₅OH, is readily soluble in water. [3]

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Total [12]

Section B Total [56]

Rough Work

A series of horizontal dotted lines for rough work.